Certificate

Certified that I have gone through the dissertation submitted by **Dr.V.KAVITHA** a student of final M.D(s) Branch V (Noi Nadal) of Government Siddha Medical College, Palayamkottai and the dissertation work has been carried out by the individual only. This dissertation does not represent or reproduce the dissertation submitted and approved earlier.

Place :

Date :

Professor H.O.D
Noi Naadal
Post Graduate Department
Government Siddha Medical College
Palayamkottai

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INTRODUCTION

Nature and Human beings are wonderful creations of God. Pray and Praise the God for creating Nature for Human beings for their better survival. It is the ultimate duty of Human beings is to protect the nature and live in nature.

Every culture in the world has developed a system of medicine Medical systems are truly Indian in origin History tells us about the supremacy of Indian culture and medicine. Siddha system of medicine was cheerfully bestowed by Lord shiva to siddhars.

Siddhars are persons holding tremendous super natural powers. Their motive of life was service of God through humanity . They were the pioneers in the research of Cosmogenesis. They were masters in Natural science, latro chemistry , Alchemy, yoga , philosophy, astrology etc.

According to siddha system of medicine , man and cosmos are unseperable and inter dependent. That's why our siddhar sattamuni said, any change in the cosmos is contemplated in the human body.

" அண்டத்திலுள்ளதே பிணடம்
பிண்டத்திலுள்ளதே அண்டம்
அண்டமும் பிண்டமும் ஒன்றே
அறிந்து தான் பார்க்கும் போதே".

\- சட்டமுனி ஞானம்

Main Basis in Siddha system of Medicine is Pancha Boodhic theory . Our human body functions homeostatically on the basis of " Tridosha theory" and the

biological functions are governed by three vital forces namely Vadham , Pitham and Kabam.

The three vital forces are based on the composition of Pancha boothic elements such as land, air, water, fire and ether. These thridhosas are maintained in homeostatic ratio 1:1/2:1/4. Progressive and persistent disturbances in this ratio deranges the physiologic functions of the body , ultimately leading to disordered pathological conditions called “Pini” or ‘noi’.

"மிகினும் குறையினும் நோய் செய்யும் நூலோர்
வளி முதலா எண்ணிய மூன்று"

This derangement basically attribute to improper food activities, seasonal variations and abnormal physical constitution of a man.

The author has selected “Asuvathamba vadham” which comes under the 80 types of Vadha diseases in “ Yugivaidhya chinthamani” for Dissertation work. It is a preliminary study about the pathology of siddha system.

SIDDHA PHYSIOLOGY

DEFINITION

The Science which deals with the functions of the living organisms and of the physical and chemical factors and the processes involved.

Siddha physiology is mainly based on 96 Thathuvas. Apart from this, physiology also constitutes, 7 physical constituents, 14 reflexes, 4 body fires, 6 suvaigal and 3 Udal vanmaigal.

THATHUVAS- 96

Each and Every cell of the human body has 96 thathuvas. It develops in the human body both physiologically and psychologically by birth.

In vedantha thathuva kattalai, it has been explained as

உறுதியாம் பூதாதி யோரைந்தாம்
உயர்கின்ற பொறியைந்து புலனைந்தாம்

----------விரித்துச் சொல்வேன்.

The 96 thathuvas are

Pootham	-	5
Pori	-	5
Polan	-	5
Kanmenthiriyam	-	5
Gnanenthiriyam	-	5

Andhakaranam	-	4
Arivu	-	1
Naadi	-	10
Vayu	-	10
Aaasayam	-	5
Kosam	-	5
Aaatharam	-	6
Malam	-	3
Mandalam	-	3
Thodam	-	3
Edanai	-	4
Gunam	-	3
Vinai	-	2
Raagam	-	8
Avathai	-	5

UDAL KATTUGAL

The human body is built up by the seven Udal thathukkal which are present in certain fixed proportions which is also a protective mechanism of the human body.

When one thathu is defective, it affects the successive thathu as each thathu receives its nourishment from the previous one . They are saaram, seeneer, oonn, kozhuppu, enbu, moolai, sukillam or suronitham.

VEGANGAL - 14

These are nothing but the natural reflexes such as conditioned and unconditioned reflexes of the human body and are the protective mechanism of the body.

They are Vadham, Thummal, Siruneer, malam, Kottavi, Pasi, Neervetkai, Kasam, Illaippu, Nithirai, Kanneer, Sukkilam and Swasam.

UDAL AGNI

These are the main anabolic activators to supply the energy to the body by the process of digestion and various cellular activities and is mediated through the samana vayu.

They are Samaakini, Mandhakini, Dheekshanaakini , Vishamaakini.

SUVAIGAL- 6

Taste is a peculiar sensation caused by the contact of soluble substance with the tongue . These must be taken in correct proportion for healthy living . They are Enippu, Pulippu, Uppu, Kaippu, Karppu, Thuvarppu.

BODY CONSTITUTION

During fertilisation , the humour determined by dietary and environmental factor determines the constitution and character of the individual. Based on this , they can be categorised as

Vadha deghi, Pitha deghi, Kapha deghi.

Each individual has a specific character and different constitution.

UDAL VANMAIGAL

Iyarkai Vanmai

It denotes the natural immunity or stamina of the body by birth.

Seyarkai vamai

It is getting by improving health by nutritious food and activities.

Kala vanmai

Development of immunity and Stamina according to environment.

These are the specific physiological aspects explained by siddhars.

RELATIONS OF UDAL THATHUVAM UYIR THATHUVAM,

ATHARAMS AND SUVAIGAL

According to this theory

Udal Thathuvam - The 96 Basic Factors located in the human body in the view of soul – mind – body constitution.

Uyir Thatuvam - The 96 Basic factors are developed by functioning of " Tri humours" physiologically.

Tri humours

Vadha means → Creative Force

Pitha means → Metabolic Force

Kapha means → Destructive Force

Aatharas

The three humours are activated by six aatharams by secreting hormonal substances. The hormonal substances working in cellular level by three ways such as

Vadha → By altering the permeability of cell membrane.

Pitha → By activating the intra cellular enzymes.

Kapha → By activating the gene.

Arusuvaigal

Finally the food products (Arusuvaigal) get metabolised and energy is derived.

Pancha Boothas

↓

96 basic factors

↓

udal thathuvam

↓

Aatharas

↓

Arusuvaigal

↓

Energy.

SIDDHA PATHOLOGY

From the physiology, we know that the cell is the basic structural and functional unit of a living organism. Any disturbance occur in its structure and function results in the disease conditions.

Siddha pathology explains the diseased condition of the body with respect to the changes in the humour due to various factors.

Schematic diagram for the origin and development of diseases and diagnosis

Dietary changes	Micro organisms	Suppression of Reflexes
Seasonal changes	Genetic factors	Immoral activities
Environmental changes	Immunological activities	

↓

Five basic elements (பஞ்ச பூதம்)

↓

3 Humours (உயிர் தாதுக்கள்)

↓

7 Physical constituents (உடல் தாதுக்கள்)

↓

Disease

↓

8 tools of diagnosis

1. Examination of pulse (நாடி)

2. Examination of touch (ஸ்பரிசம்)

3. Examination of tongue (நா)

4. Examination of complexion (நிறம்)

5. Examination of Voice (மொழி)

6. Examination of eyes (விழி)

7. Examination of Feaces (மலம்)

8. Examination of urine (மூத்திரம்)

↓

Diagnosis.

The pathological lesions are mainly caused when the changes occur in 6 suvaigal, 7 thathus, 3 humours, Three gunas, Seasonal Characters (Paruvakalam) , and type of living places (Thinaigal).

DIET (Suvaigal)

Food, the constituent of energy is responsible for our activites . According to Siddha system, the daily food comes under 6 main tastes mentioned earlier . Speciality of the man is his adaptations to the changes or variations in the nature by his food habits and activities . The tastes, altering the humours due to the ignorance of the dietary adaptations .

”புளி துவர் விஞ்சுங் கறியால் பூரிக்கும் வாதம்
ஒளி யுவர் கைப்பேறில் பித்துச் சீறும் - கிளிமொழியே
கார்ப்பினிப்பு விஞ்சில் கபம் விஞ்சும் சட்டிரதச்
சேரப்புணர் நோயணு காதே”.

ie:

Vadham - Increases with increase in sour and astringent tastes.

Pitham - Increases with increase in salt and bitter tastes.

Kabam - Increases with increase in sweet and pungent tastes.

Changes in Udal Thathus

The seven thathus are responsible for the entire structure of the body . They are Saaram, Senneer, Oonn, Kozhuppu, Enbu, Moolai and Sukkilam or Suronitham.

" இரசம் உதிரம் இறைச்சி தோல் மேதை
மருவிய வத்தி வாழும் பொடு மச்சை
பரவிய சுக்கிலம் பாழாம் உபாதி
உருபம லாலுடல் ஒன்றெனலாமே"

Seven udal thathukkal maintain the function of different organs, systems and vital parts of the body. They plays a very important role in the development and nourishment of the body.

These are responsible of biological protective mechanism and immune mechanism . If any one of the thathu is defective, it affects the successive thathu. Each thathu receive its nourishment from the previous thathus.

SAARAM (Rasa)

Rasa is the essence of digested food and circulated all over the body by "Vyana vaya"

Function - Nourishing and production of blood.

Increased State

- Excessive Salivation
- Anorexia
- Body ache, cough, excessive sleep.

Decreased State

- Wasting of muscles
- sound intolerence
- Generalised Weakness.

2. SENEER – Produced from rasa thathu.

Function - Responsible for sustenance of life and provide colour and complexion to the skin.

Increased State

- Haemangiomas
- Splenomegaly
- Jaundice
- Mental Disorders
- Blood dyscraisis
- Hyper pigmentation.

Decreased State

- Anaemia
- Dry Skin
- Nervous Weakness.

3. OONN – Produced from Raktha.

Function – Strengthens the body.

Increased stage

- Tumours
- Carcinoma
- Goitre
- Cyst
- Musculature.

Decreased State

- Wasting
- Dryness
- Cracking Sound in Joints.

4. Kozhuppu – Produced from Oonn.

Function – Maintains lubrication of all tissues and gives energy to the body.

Increased State

- Obesity.
- Increases musculature with deposition.
- Hypercholesterolemia.

Decreased State

- Wasting of muscles.
- Decreased Stability of Hip Joint and other joints.
- Lethargy.

5. ENBU - It indicates bones and cartilages**.**

Function - Gives the structural frame work to the body.

Increased state

- Hypercalcinosis
- Extra teeth formation
- Hypertrophy of bone.

Decreased state

- Osteoporosis
- Rickets.

6. MOOLAI - Denotes bone marrow, nerves, grey and white matter of central nervous system.

Function - Production of blood cells.

Increased State

- Bone and Joint diseases.
- Ulcers.
- Feeling of heaviness in eyes and body.

Decreased state

- Demyelination
- Osteomylitis
- Delusions
- Giddiness.

Sukillam - Denotes reproductive fluids of both male and female.

Function – Reproduction.

Increased State

- Stone in urethra.

Decreased State

- Increased impotency.
- Infertility.
- Weakness.

INCORRECT TRI – HUMOURS

I. VADHA DHOSA

Exaggerated

- Darkness of motion
- Body pain
- Pricking Pain
- Constipation
- paralysed limbs
- mental distress.

Decreased

- Difficulty in Working
- Impairment of intelligence
- Increased Kapha symptoms.

II. PITHA DHOSA

Exaggerated

- Yellowish discolouration of skin, urine
- Increased appetite
- Increased thirst
- Burning sensation
- Decreased sleep.

Decreased

- Loss of appetite
- Indigestion.
- Cold.

III. KAPHA DHOSA

Exaggerated

- Chills with rigor
- pallor
- Tightness
- Cough
- Fullness of stomach
- Excessive sleep
- Dyspnea.

Decreased

- Destruction of Joint
- Giddiness

- Increased Sweating
- Papitation.

SEASONAL VARIATIONS (Paruvakaalam)

Kaarkalam (Avani and Purattasi)	Vadham ↑↑ Pitham ↑
Koodhirkaalam (Iyppasi & karthigai	Vadham (-) Pitham ↑↑
Munpani Kaalam (margali & Thai)	Pitham (-)
Pinpani Kaalam (Masi & Panguni)	Kabam ↑
Elaveenir Kalam (Chithirai and Vaigasi	kabam ↑↑
Mudhuveenir kalam (Aani and Aadi)	Vadham ↑ Kabam (-)

↑ - Thannilai Valarchi

↑↑ - Vettrunilai valarchi

(-) - Thannilai Adaithal.

ENVIRONMENTAL CHANGES (Thinaigal)

Kurinji **-** Kabha diseases

Mullai **-** Pitha diseases

Neythal - Vadha diseases

Marutham - No disease will occur

Palai - Mukkuttra diseases.

INHIBITION OF VENGANGAL

These are the urges must be needed. If they are inhibited from their normal physiological pathway they cause diseases.

Vaadham (Abana Vaya) - Chest pain , peptic ulcer, abdominal pain, body ache, constipation , oliguria and Indigestion.

Thummal - Head ache, Facial pain, back pain, pain in the sense organs etc.

Siruneer - Ulcers in the urethral orifice, joints pain, urinary tract infection etc.

Malam - Calf muscle pain, head ache, general debility, flatulence and other disease.

kottavi - indigestion, contracture in the face.

pasi, neervetkai → Constitution for the body is totally distributed , emaciation.

Kasam - Chest disorders supervene.

Illaippu – Ulcer and other mega diseases.

Nithirai - Heaviness of the head, eye pain, deafness, speech disturbances.

Vaanthi – Urticaria, skin diseases, toxic manifestation, anaemia, eye diseases.

Kanneer- Eye diseases, head ache, sinusitis, and heart diseases.

Sukkilam – Joint pain, fever, chest pain, difficulty in micturition.

Swaasam – Cough, abdominal discomfort, anorexia .

Thus by these factors, the normal picture of the humours are shuffled and are expressed as diseases.

DIAGNOSIS (Piniyari Muraimai)

Evangai Thervugal [8 tools of diagnosis]

"நாடிப்பரிசம் நாநிறம் மொழிவிழி

மலம் மூத்திரமிவை மருத்துவராயுதம் " என்பதனாலும்

"மெய்குறி நிறந்தொனி விழி நாவிருமலம் கைக்குறி

- தேரையர் வாக்கினாலும்

"தரணியுள்ள வியாதி தன்னை யட்டாங்த் தால்

தானிய வேண்டுவதுயதோ வென்னில்

திரணியதோர் நாடி கண்கள் சத்தத்தோடு

தேகத்தினது பரிசம் வருணம் நாக்கு

யிரண மலமூத்திரமா மிவைகளெட்டும்

பாதம் படவேதான் பார்த்துக் குறிப்புக் கண்டு

பரணருளால் பெரியோர்கள் பாதம் போறிப்

பண்பு தவறாமல் பண்டிதஞ் செய்வீரே".

- குணவாகட நாடி என்பதினாலும்

The eight entities are

- Naadi, sparism, Naa, Niram, Mozhi, Vizhi, Malam, Moothiram.

These eight entitles can be executed in the methods of

Poriyaalaridhal

Pulanaalaridhal

Vinaadhal.

NAADI - Most important method of diagnosis . It is the rhythmic expansion of the artery and felt in the radial artery by three fingers . Such as fore finger (vadham), middle finger (pitham) and ring finger (kabam) in the ratio 1: ½: ¼ .

For male – Felt is Right hand.

For female - Felt in left hand.

If there is any alteration in uyir thathukkal, it is reflected through naadi.

SPARISM

It deals about the changes is the skin such as Temperature of the skin (warm or cold) smoothness or roughness, dryness, scaling, swelling, any abnormal growth, tenderness, pigmentation, fissures etc.

NAA

The tongue has been regarded as an invaluable clinical indicatory of health and disease.

It includes colour of the tongue , deposition of the tongue , increased salivation, dryness , ulceration, fissured tongue, micro glossia, macro glossia , abnormal growth etc.

NIRAM

Niram denotes the colour of the peripheral organs . In includes colour of eyes, tongue, mucous membrane, erythema, hypo or hyper pigmentation.

THONI

It includes the changes in the tone of speech modulation ,pitch , sound , fluency, stammering, repetition , answering, difficulty is articulations.

VIZHI

Eye examination is an indispensable parameter for the physician in the diagnosis of a disease . It deals about vision. Changes such as loss of vision, blurred vision, dull vision , changes in visual perception , movements in eye lids and eye balls , lacrimation ,dryness etc.

MALAM

It is the metabolic end product of food substances. Examination includes nature of malam, whether it is solid, semisolid, or liquid and its colour, contents and consistency.

MOOTHIRAM

Urine plays an important role in revealing the diseased state in the form of changes in colour, specific gravity, odour, frequency, froth, deposits.

COLLECTION OF URINE SPECIMEN FOR NEER KURI & NEIKURI

Prior to the day of urine examination , the patient should be advised to take a balanced diet and should have a good sleep . The early morning specimen is collected in a glass container. The colour of the urine is noted.

NEERKURI

"வந்த நீர்க்கரிஎடை மணம் நுரை எஞ்சலென்
றைந்தியலுளவை யறைகுது முறையே".

Niram - Indicates colour of the urine such as yellow, red ,

green,black , crystal etc.,

Edai - It indicates specific gravity of urine.

Manam - It indicates the smell of urine such as pleasant , foul smelling, honey smell etc.

Nurai - It indicates the frothy nature of urine.

Enjal - It indicates the frequency of micturation such as oliguria, polyuria, anuria.

NEIKURI

"நிறக்குறிக் குரைத்த நிருமாண நீரிற்
சிறக்க வெண்ணெய்யோர் சிறுதுளி நடுவிடுத்
தெறுறத் திறந்தொலி யோகாதமைத்ததி
னின்ற திவலை போம் நெறிவிழி யறிவும்
சென்றது புகலுஞ் செய்தியை யுணரே".

The urine specimen is kept in a wide mouth glass bowl being exposed well to bright light . But should not be disturbed by the movement of the wind . Then add one drop of gingely oil . Observe keenly the position and spreading of the oil drop.

Oil spreading like snake indicates Vadha neer.

Oil spreading like ring indicates Pitha neer.

Oil remains floating as a pearl means kabam.

AIM AND OBJECTIVES

Siddhars have identified four thousand four hundred and forty eight diseases and scientifically arranged eighty types of Vadha diseases, forty types of pitha diseases, twenty types of Kapha diseases and so on.

Noi Naadal (or) identification of disease and Noi muthal naadal (or)determination of aetiology of the disease are most important aspects . Once the diagnosis is accurate, the treatment may be easily fulfilled.

" பொற்றா மரையான் புனைமெய் யரண்காக்கும்
பொற்றா மரையான புகல்வதென் - பொற்றாம்
வளவினிலே யாக்குரம்பை மன்னென்ன மன்ன
வளவினிலே யாக்கும் வளி ".

\- தேரையர் யமக வெண்பா

வாதத்தினை பெருமைப்படுத்தி கூறும் பொழுது , தேரையர் பிரமணாற் சிருஷ்டிக்கப்பட்ட நவத்துவாரங்களையுடைய அநித்யமான இச்சரீரத்தில் உயிர் தங்கியிருக்கும் வரையில் நிலைபெறச் செய்வதாகிய வாதமானது இச்சரீரமாகிய கோட்டையை அரசாட்சி புரியும் வேந்தனென்று புகழ் பெற்றதாதலின் அதன் பெருமையை யான் என்னென்று உரைப்பேன் என்பதனால்

The author has selected "**அசுவதம்ப வாதம்**" which comes under Vadha diseases.

The main aim of the present study is to define Aetiology. Pathology, Symptomatology and diagnostic method of " Aswathamba vadham" by synchronizing the evidences found in various siddha literatures and formulating

then after a detailed study into an acceptable form that will be applicable and approachable in this modern world.

The following objectives have been drawn to achieve the above aim

- To collect siddha literatures about vadha diseases in general and **"Aswathamba Vadham"** in particular.
- To know the specific aetiological factors.
- To analyse the signs and symptoms.
- To find out the changes that occur in Uyir thathukkal , udal kattukkal and envagai thervugal.
- To have an idea of an incidence of the disease with age , sex, socio economic status, habits.
- To have a detailed clinical investigations and utilize the possible diagnostic tools in modern parameter in the diagnosis of the diseases.

READING LINES BETWEEN YUGI'S POEM

In yugi vaidhya chinthamani, Under vadha raga nithanam, " Asuva thamba vadham" is dealt with, he mentioned in his book as 284th stanza and 285th stanza

அசுவதம்ப வாதம்

வாதமா யுடல் வெளுத்து வடிவெல் லாநோம்
மயக்கமோ டிருமலா யீளை யுண்டாம்
நேதமாய் நெஞ்சடைத்துப் பொறிக லங்கும்
நெருப்பாக உடல்காணு நெடுமூச் சுண்டாம்
கோதுதான் மயக்கத்தில் மருந்தி னீட்டால்
குளிர்ச்சியாய்க் கோபிக்குங் கூச்ச முண்டாம்
பாதந்தான் றிமிருண்டாய் முட்போலாகும்
பருத்தஅ சுவதம்பம் பகர லாமே

பகரவே வாதமது கோபித் தப்போ
பண்பாக ஸ்திரீகோஷ்டி யதுதான் செய்யில்
நகரவே வெகுதூர வழிநடக்கில்
நளிரான காற்றுமே பனிமேற் பட்டால்
மிகரவே காய்கள்கனி கிழங்கு தன்னை
மிகவருந்தி மீறியே தயிர்தான் கொண்டால்
முகரவே முதுகெலும்பை முறுக்கி நொந்து
முழங்காலுங் கணைக்காலுங் கடுப்புண்டாமே.

The meaning of the words in this poem

வெளுப்பு	-	Pallor
வடிவம்	-	Structure of the whole body
மயக்கம்	-	Giddiness
இருமல்	-	Cough
ஈளை	-	கோழை
நெஞ்சடைப்பு	-	Spasmodic Suffocation
பொறி	-	organ of senses
நெருப்பாக	-	Hyperpyrexia
நெடுமூச்சு	-	Breathing with heave
திமிருண்டாய்	-	Numbness
முட்போலாகும்	-	Pricking pain sensation
கோபித்தல்	-	Inflammation
முதுகெலும்பு	-	Vertebral Coloumn
முறுக்கி	-	Distorting (or) twisting
நொந்து	-	Weakness , அழிந்து
முழங்கால்	-	Knee Joint
கணுக்கால்	-	Ankle Joint
கடுப்பு	-	Pain.

பொருளுரை

யூகிமுனிவர் "அசுவதம்ப வாதம்" என்ற தலைப்பின் கீழ் கூறியுள்ள இரண்டு பாடல்களில் முதல் பாடலில் குறிகுணங்களையும் இரண்டாவது பாடலில் காரணங்களையும் கூறியுள்ளார்.

வாதமானது உடலில் அதிகரித்து உள்ள போது ஸ்திரீ போகம் செய்வதாலும் , வெகுதூரம் நடப்பதினாலும் குளிர்ச்சியான காற்று, பனி உடலில் படுவதாலும் , காய், கனி, கிழங்கு வகைகளை அதிக அளவில் உட்கொள்வதாலும், தயிரினை அளவிற்கு மீறி உட்கொள்வதாலும், முதுகெலும்பில் முறுக்கினாற் போல் வலி உண்டாகும் . மேலும் முழங்கால் , கணுக்கால் இவற்றில் வலி உண்டாகும்.

உடல் வெளுப்பு, உடல் முற்றும் வலி , மயக்கம் , இருமல் , ஈளை, நெஞ்சடைப்பு, ஐம்பொறிகள் வன்மை கெடல், உடலில் வெப்பம் அதிகரித்தல் , நெடுமூச்சு , கூச்சம் ஆகிய குறிகுணங்களுடன் பாதத்தில் திமிர் உண்டாகி முட்போலாகும்.

The clinical features depicted in this poem are

- Spasticity of the legs.
- Anaemia.
- Generalised malaise.
- Giddiness.
- Cough with expectoration.
- Hyper pyrexia.
- Dyspnoea.
- Nervousness.
- Numbness and flaccidity of the foot.

DETAILED PATHOLOGICAL VIEW OF DISSERTATION TOPIC

வாதமா யுடல் வெளுத்து வடிவெல் லாநோம்
மயக்கமோ டிருமலா யீளை யுண்டாம்
நேதமாய் நெஞ்சடைத்துப் பொறிக லங்கும்
நெருப்பாக உடல்காணு நெடுமூச் சுண்டாம்
கோதுதான் மயக்கத்தில் மருந்தி னீட்டால்
குளிர்ச்சியாய்க் கோபிக்குங் கூச்ச முண்டாம்
பாதந்தான் றிமிருண்டாய் முட்போலாகும்
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மிகரவே காய்கள்கனி கிழங்கு தன்னை
மிகவருந்தி மீறியே தயிர்தான் கொண்டால்
முகரவே முதுகெலும்பை முறுக்கி நொந்து
முழங்காலுங் கணைக்காலுங் கடுப்புண்டாமே.

The chief clinical features depicted in this poem are

"முகரவே முதுகெலும்பை முறுக்கி நொந்து"

If there is any destruction or distortion occurs in the vertebral column , severe twisting pain occurs in the vertebral region.

Due to the loss of periosteal blood supply, marked hypeareamia and severe Osteoporosis takes place. Osseous destruction takes place by the lysis of bone which is thus softens and easily yield under the effect of gravity and muscle action leading to compression, collapse or destruction of bone

Due to ischemic infarction of the segments of the bone also causes destruction and vertebral collapse. This change is secondary to any arterial occlusion due to thrombo embolic phenomenon, endarteritis and periartertis.

II. "முழங்காலுங் கணைக்காலுங் கடுப்புண்டாமே"

Pain and Weaknes occurs in the knee joint and Ankle joint occurs due to compression of the spinal cord.

When any compression starts anterior to the spinal cord, it shows earliest manifestation as gradual increase in the spasticity . As compression increases, anterior coloumn of the cord is affected more and patient starts losing motor power gradually from partial motor weakness to complete motor loss.

Due to any compression in the motor fibres of the spinal cord, weakness occurs in the knee and ankle joint.

III. " பாதந்தான் றிமிருண்டாய் முட்போலாகும்"

Flaccidity of the foot occurs due to compression of the spinal cord.

Cord compression cause complete block to conduction in anterior column and lateral column of the spinal cord . This produces reduction of sensation such as pain, temperature and crude touch.

When compression is further increased, even posterior column is also affected, leading to the complete loss of sensation. In long standing compression, the spasticity is replaced by flaccidity and flexor spasm.

HIGHLIGHTS OF DISSERTATION TOPIC

“Asuvathamba vadham” is one of the eighty vadha diseases, explained in “ Yugi Vaidhya Chinthamani”.

In this research work, the author comes into conclusion mainly by the line

“ முகரவே முதுகெலும்பை முறுக்கி நொந்து “ which means distortion or severe twisting pain present in the vertebral region.

From the modern (Allied) parameters, the severe twisting pain present in the vertebral region is due to infection of Tubercle bacilli in the spine.

Without any parameters in the ancient period , Yugi muni clearly depicted the clinical features caused by the infection of the Tubercle bacilli in the spine and its complications in Asuva thamba vadham.

It is necessary to know about vadham before entering into the conclusion.

Vadham

Vadham is one of the vital humours from which the body is constituted. It is the combination of Air and Ether.

Characters of Vadham

Varatchi (Dryness).

Lesu (Lightness).

Kulirchi (Coldness).

Asaidhal (Mobility).

Anuthuvam (Subtleness).

Opposite Qualities

Mirudhu (Softness).

Pasumai (untuousness).

Baluvu (Heaviness).

Akkini (Hot).

Sthiram (Stability).

Ketti (Solid).

Dwelling places

Abanan.

Idakalai.

Kaamakodi.

Undhiyin keezh moolam.

Hip.

Bones.

Muscles.

Nerves.

Joints.

Skin.

Hair follicles.

Stools.

Functions

Refreshment.

Respiration.

Maintenance of body and mind is a balanced state.

Regulation of 14 reflexes.

Enhancement of functions of Udal Kattugal.

Protection and strengthening of the sense organs.

Aetiology of vadha diseases

"தானென்ற கசப்போடு துவர்ப்புறைப்பு
சாதகமாய் மிஞ்சுகிலும் சமைத்த வன்னம்
ஆனென்ற வாறினும் புசித்தாலும்
ஆகாயத் தேறலுது குடித்தாலும்
பானென்ற பகலுறக்கம் மிரா விழிப்பு
பட்டினியே மிகவுறுதல் பார மெய்தல்
தேனென்ற மொழியார் மேற் சிந்தையாதல்
சீக்கிரமாய் வாதமது செனிக்குந்தானே"

- யூகி வைத்திய சிந்தாமணி

"புளிதுவர் விஞ்சுங் கறியாற் பூரிக்கும் வாதம்"

Character of vadha diseases

" காணப்பா வாதமீறில் கால் கைகள் பொருந்தி நோகும்
பூணப்பா குடல் புரட்டும் மலசலம் பொருமிக் கட்டும்
ஊணப்பா குளிருங் காய்ச்சல் உடம்பெல்லாம் குத்து வாய்வு
வீணப்பா குதமிறுக்கும் வியர்வையும் வேர்க்கும் தானே"

- அகத்தியர் வைத்திய காவியம்

"வாதத்தின் குணமே தென்னில் வயிறது பொருமிக் கொள்ளும்
தாதுகளுலர்ந்து கை கால் சந்துக்கள் கடுப்புந் தோன்றுந்
தீதுற்றச் சிறுநீர் தானுச் சிறுத்துடன் கடுத்து வீழும்
போதுற்ற வாதமென்ற புகன்றனர் முனிவர் தாமே"

- அகத்தியர் ஆயுள் வேதம்

" எறிய நல்வாத மெறிக்குங் குணங்கேளு
குறியெனக் கைகால் குளைச்சு விலாசந்து
பறியென நொந்துடற் பச்சைப் புண்ணாகுமே
புண்ணாய் வலிக்கும் பொருமும் குடலோடித்
தண்ணா மலத்தைத் தம்பிக்கும் போக்காது
ஒண்ணான ஆசனம் உறவே சுரக்கிடும்
பண்ணார் குளிர் சீதம் பருத்திடும் வாதமே"

- திருமூலர் வைத்திய சாரம்

-

"அறியதிம் மூன்றினது ஆண்மை சொன்னார்நந்தி
எறிய நல்வாதம் எரிக்கும் குணங்கேளு
குறியெனக் கை , கால் குளைச்சு விலாசந்து
புறியென நொந்துடல் பச்சை புண் போலாமே
புண்ணாய் வலிக்கும் பொருமும் குடலோடு
துன்னா மலத்தை தம்பிக்கும் போக்காது
ஓன்னான ஆசனம் உறவே சுருக்கும்
பன்னார் குளிர் சீதம் பருத்திடும் வாதமாமே"

- திருமூலர் கருக்கடை வைத்தியம் - 600

The major and common cardinal symptoms of vadha diseases as mentioned above are

- Joints pain.
- Swelling.
- Difficulty in walking.
- Constipation.
- Loss of appetite.
- Burning micturition and oliguria.
- Dyspnoea.
- Flatulence.
- Fatigue.
- Giddiness.
- Fever etc.,

From the character of vadham , etiology and symptoms of vadha diseases mentioned in the various Siddha literatures, the symptoms such as joint pain and swelling , difficulty in walking, Dyspnoea, loss of appetite, fatigue, fever, giddiness occurs.

EVALUATION OF THE DESSERTATION TOPIC

MATERIALS AND METHODS

The clinical study on Topic **"Asuvathamba vadham"** was carried out in Post Graduate Department of Noi-Naadal Branch in Government Siddha Medical College, Palayamkottai . In this study , the patients were treated as out patients.

Selection of cases

The author has selected 5 cases with similar symptoms of "Asuvathamba vadham". Out of which 2 cases were take for this dissertation under the supervision of Professor and Lecturer of Noi – Naadal Department . The author has selected the cases to evaluate typical picture by modern parameters also.

Clinical features of Asuvathamba vadham

- Back pain.
- Numbness or weakness of the legs.
- Anaemia.
- Generalised malaise.
- Fever.
- Dyspnoea.
- Cough with expectoration.

Evaluation of clinical parameters

Siddha diagnosis was made with the help the following methods such as

1. Mukkutra Nilaigal.
2. udal Thathukkal nilaigal.
3. Envagai Thervugal.

Results were observed with respect to the following criteria

1. O.P.list

S.No	Date	O.P.No	Name	Age	Sex
1.	28.04.06	29774	Karpooraselvi	19	F
2.	2.05.06	31497	Sirajudeen	67	M

2. Sex distribution

The incidence of "Asuvathamba vadham" is common to both sexes.

3. Age reference

The symptoms of "Asuvathamba vadham" affects people belong to any age group.

4. Socio – economic status

The occurrence of "Asuvathamba vadham" symptoms are mostly in people under the poor socio - economic status.

5.Family History

No incidence of “Asuvathamba Vadham” in the Family History.

6. Clinical Presentation

1. Pain in the back of the body - present
2. Weakness of the legs - present
3. Anaemia - present
4. Generalised malaise - present
5. Cough with expectoration - present
6. Hyper pyrexia - present
7. Dyspnoea - present
8. Numbness and flaccidity of the foot - present

SIDDHA PARAMETERS

7. Mukkutra nilaigal

Distribution of vadham

1) Pranan - Dearrangement was observed.
2) Abanan - Dearrangement was observed.
3) Vyanan - Dearrangement was observed.
4) Udanan - Dearrangement was observed.
5) Samanan - Dearrangement was observed.
6) Naagan - was found to be normal.
7) Koorman - was found to be normal.

8) Kirukaran - Dearrangement was observed.

9) Devadathan - Dearrangement was observed.

Distribution of Pitham

1) Anar pitham - Affected.

2) Ranjagam - Affected.

3) Saathagam - Affected.

4) Aalosagam - Normal.

5) Pirasagam - Affected.

Distribution of Kaam

1) Avalambagam - Affected.

2) Kilaethangam - Affected.

3) Pothagam - Affected.

4) Tharpagam - was found to be normal.

5) Sadhigam - Affected.

8. Udal Thadhukkal Nilaigal

The condition of Udal thadhukkal has been observed in selected cases.

1. Saaram - on observation, the character of saaram was decreased.
2. Senneer - The character of senner was affected.
3. Oonn - On observation, the character of Oonn was decreased.
4. Enbu - The character of Enbu was affected.

5. Kozhuppu - On observation, the character of Kozhuppu was Decreased.
6. Moolai - The character of Moolai was affected.
7. Sukkilam / Suronitham - was found to be normal.

ALLIED PARAMETERS

The following parameters were done in all patients.

1. **Blood investigations**

   Total count, Differential count, Estimation of haemoglobin, Erythrocyte Sedimentation rate, sugar, urea, creatinine.

2. **Urine Analysis**

   Albumin, Sugar and Deposits.

3. **Other Investigations**

   - Mantoux test.
   - Radiographs of the spine.
   - Computed Tomography of the spine.
   - Magnetic Resonance Imaging of spine.
   - Antigen Antibody Reaction.

PICTURE OF EN VAGAI THERVUGAL

The cases were studied for changes in Naadi, Sparism, Theni, Vizhi, Naa, Niram Malam and moothiram

S.No	Name	Naadi	Sparism	Naa	Niram	Mozhi	Vizhi	Malam	Moothiram	
									Neerkuri	Noikuri
1.	Karpoora Selvi	Vadhakabam	A	A	A	NA	NA	NA	Manjal	Viraindhu paravudhal (Spreads completely
2.	Sirajudeen	Vadhakabam	A	A	A	NA	NA	NA	Ilam Manjal	Viraindhu paravudhal And attains the shape

A – Affected
NA – Not Affected

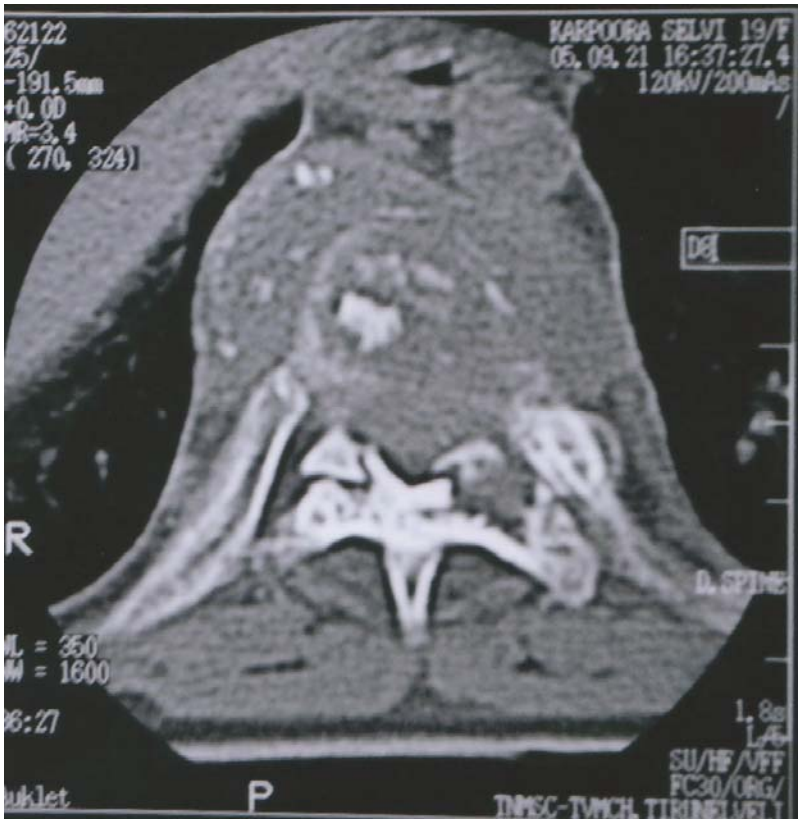
ALLIED PARAMETERS

Laboratory investigations of selected 15 cases

S.No	O.P.No	Age	Sex	Blood				ESR		Biochemical			Urine			Motion	
				TC	DC												
				cells/cumm	P%	L%	E%	1/2Hr mm	1Hr mm	HB Gms%	Sugar Mgs%	Urea Gms%	Alb	Sug	Dep	Ova	Cyst
1.	29774	19	F	9600	69	29	12	60	90	8.6	110	28	Nil	Nil	2-3 epicells 5-6 puscells	Nil	Nil
2.	31497	67	M	8300	65	34	17	70	110	9.6	98	26	Nil	Nil	Nil	Nil	Nil

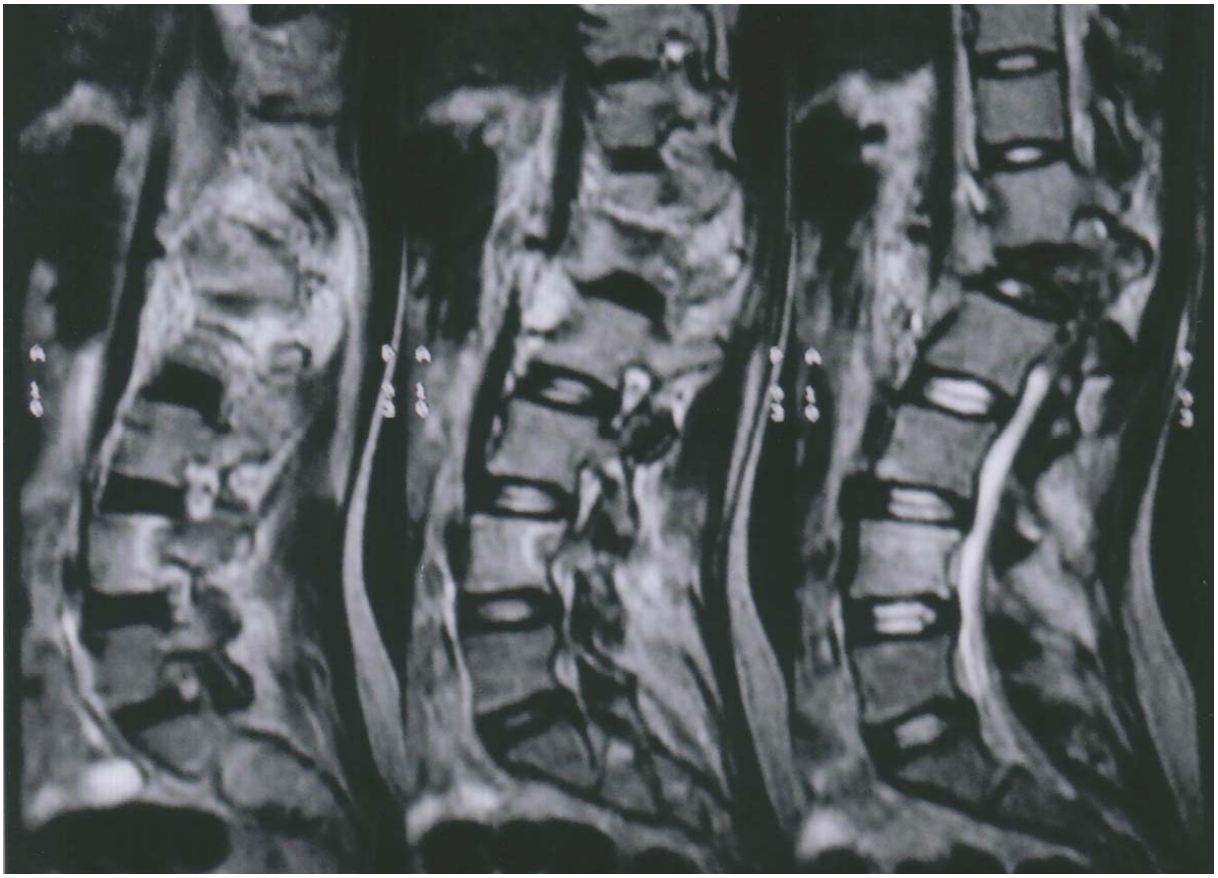
S.No	O.P.No	Age	Sex	Mantoux Test	Antigen Antibody Reaction
1.	29774	19	F	Positive	TBM – Positive
2.	31497	67	M	Positive	TBM- Positive

Name : Karpoora Selvi
Age/sex : 19/F
O.P.No : 29774



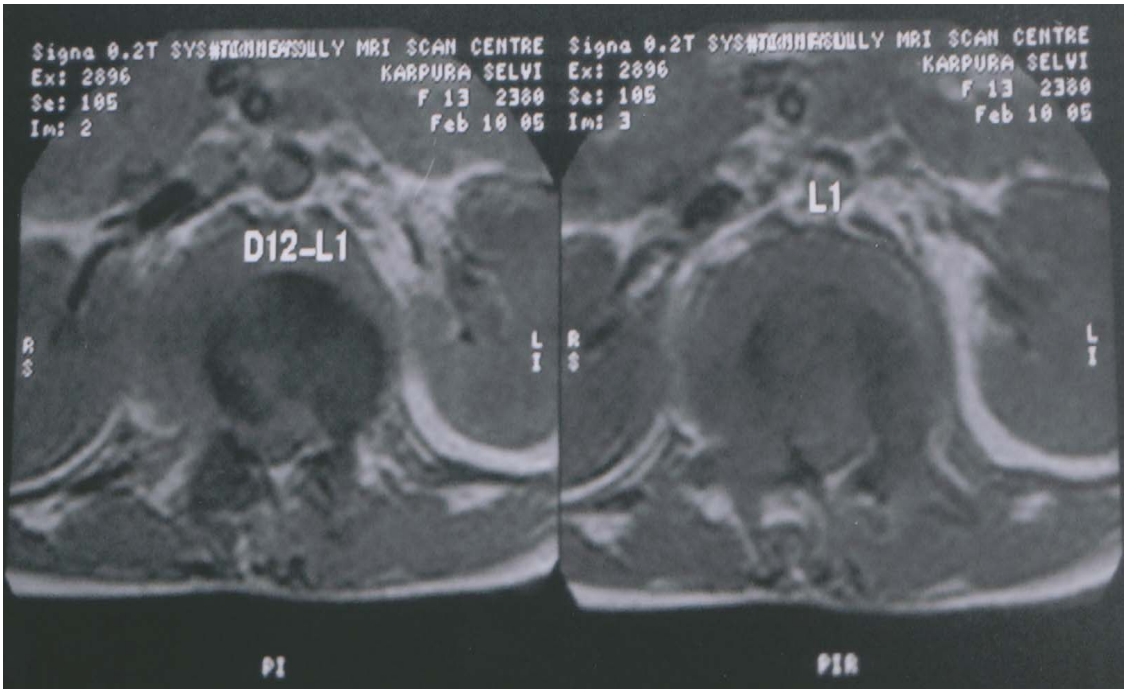
Complete Destruction of D8

Name : Karpoora Selvi
Age/sex: 19/F
O.P.No: 29774



Alteration of alignment at D_{12} – L_1 with acute Kyphosis and Compression of cord at the level.

Name : Karpoora Selvi
Age / Sex : 19/ F
O.P.No: 29774



Impression

MRI Study Show

- Multifocal TB lesion of D_8 , D_{12} and L_1 with paravertebral and intra spinal cold abscess with cord compression at $D_{12} – L_1$

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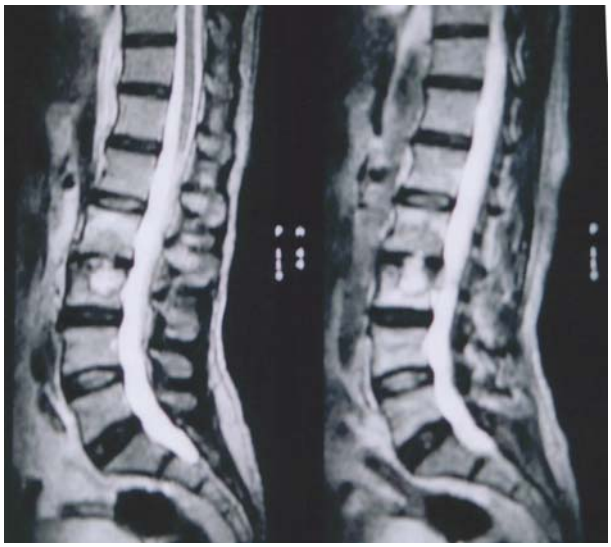
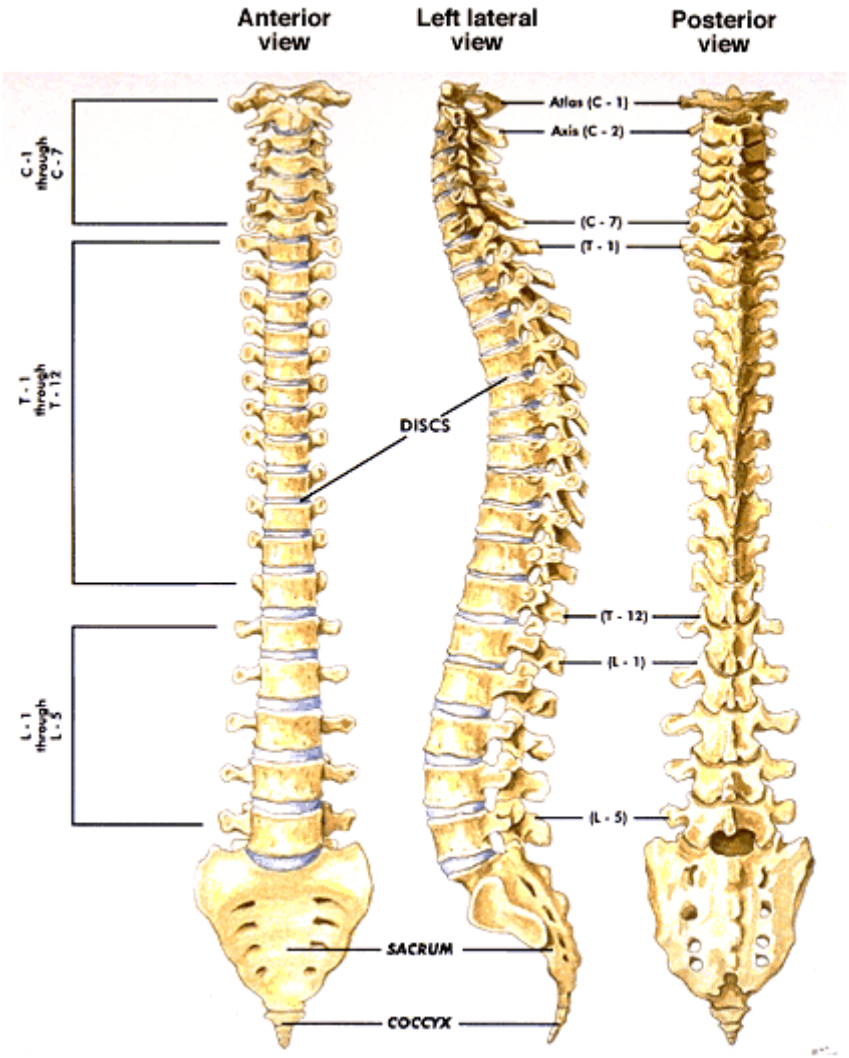


Impression : MRI STUDY SHOW

Possibility of Pott's spine L_2 / L_3 level . Annular disc buldge L_3 – L_4 , L_4 - L_5 and L_5 – S_1 with nerve root compression

VERTEBRAL COLOUMN



MODERN ASPECTS

ANATOMY

Anatomy is the science which deals with the structural organization of the body

Vertebral coloumn

The vertebral coloumn forms back bone of the body . if forms a parts of the axial skeleton. It is made up of 33 pieces of vertebrae and intervening intervertebral discs.

Length

60-70cm

There are 7 cervical vertebrae, 12 thoracic vertebrae and 5 lumbar vertebrae.

5 pieces of sacral vertebrae unite to form sacrum.

4 pieces of coccygeal vertebrae unite to form the coccyx.

curvatures of the vertebral coloumn

Vertebral coloumn has curvature . The curfvature are classified into

Primary curvatures.

Secondary curvatures.

Primary Curvature

In the early fetus, the vertebral coloumn is essentially C shaped with its concavity anterior, by the time of birth, the cervical curve has begin to reverse itself

and the lumbar coloumn is approximately straight, but the thoracic and sacral portions retain some of their original concavity and thus constitute the primary curves of the vertebral coloumn.

Secondary curvature

The curves which are convex anterierly are found in the cervical and lumbar regions. The cervical curve appears when the infant holds its head up after the third month, the lumbar curve develops when the child begins to sit and walk, and holds the trunk up right . The curves continue to develp until growth stops at about the age of 17 years . Wedging of the intervertebral discs contributes to the spinal curves and the sharp angle between the lowest lumbar vertebrae and the sacrum.

The curvatures and inter vertebral discs are compliments of shock and absorbing nature of verterbral coloumn.

Intervertebral discs

The intervertebral discs are responsible for one quarter of the length of the vertebral coloumn . They are thickest in the cervical and lumbar regions, where the movements of the verterbral column are greatest. They may be regarded as semielastic, which lie between the rigid bodies of adjacent vertebrae.

Parts of Intervertebral Disc

1. Nucleus pulposes.
2. Annulus fibrosus.
3. Cartilage plate.

Nucleus pulposes

Developed form the noto chord.

Structure

Nucleus pulpose is a fibro cartilaginous pulp. It is surrounded by annulus fibrosus . It has mucinous substance and mucopolysaccharides.

Annulus fibrosus

There are about a dozen of fibrous rings arranged concentrically around nucleus pulposus. It provides resilence to the inter vertebral disc. It is firmly attached to the bodies of adjacent vertebrae. Thus a symphysis type of joint is formed.

Cartilage plate

They are situated on either sides of the nucleus pulposes. They are representing non ossified parts of the vertebral epiphyseal plate.

Intervertebral Joint

The vertebrate from the second cervical to the first sacral articulate by

1. A series of fibro cartilaginous joints formed by the inter vertebral discs between the vertebral bodies.
2. A series of paired synovial joints between the posterior articular process and are designated as apophyseal joints.

Blood supply to the vertebral coloumn

The vertebrae and the longitudinal muscles attached to them are supplied by segmental arteries. The ascending cervical , the intercostal and the lumbar arteries

give multiple small branches to the vertebral bodies . In thoracic and the lumbar regions, the muscles receive posterior branches of the intercostal , lumbar and lateral sacral arteries.

Venous drainage

The richly supplied red marrow of the vertebral body drains almost wholly by a pair of large basi – vertebral veins into the internal vertebral plexus . Drainage of the neural arch and of the attached muscles is into the external vertebral plexus . The external vertebral plexus intra muscular are non co-existent over the bare fronts of the vertebral bodies. The internal and external vertebral plexus together drain into the regional segmental veins (Vertebral, posterior, inter costal, lumbar and lateral sacral vein). In the pelvis, venous communication is thus established with the pelvic viscera, in the abdomen with the renal veins, in the thorax with the veins of the breast that enter the intercostal veins and in the neck with the inferior thyroid via the brachio cephalic vein.

General characteristics of the vertebrate

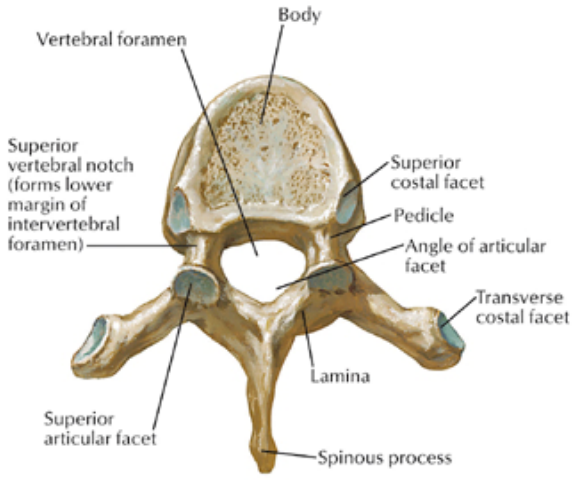
Although vertebrae show regional differences they all possess a common pattern.

A typical vertebrae consists of a rounded body anteriorly and a vertebral arch posteriorly. These enclose a space called the vertebral foramen through which run the spinal cord and its coverings . The vertebral arch consists of a pair of cylindrical pedicles which form the side of the arch and a pair of flattened laminae, which complete the arch posteriorly.

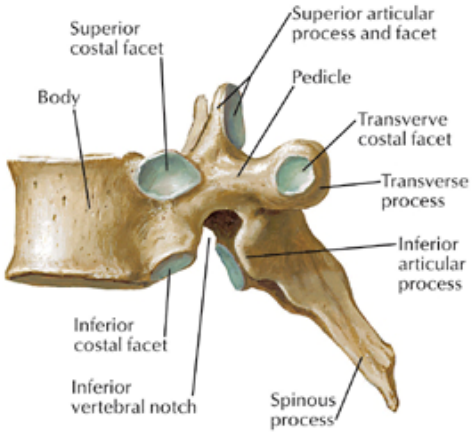
The vertebral arch gives rise to seven process one spinous, two transverse and four articular process.

The spinous process or spine is directed , from the junction of the two laminae. The transverse process re directed laterally from the junction of the laminae and the pedicles . Both are spinous and transverse process serves as levers and receive attachments of muscles and ligaments.

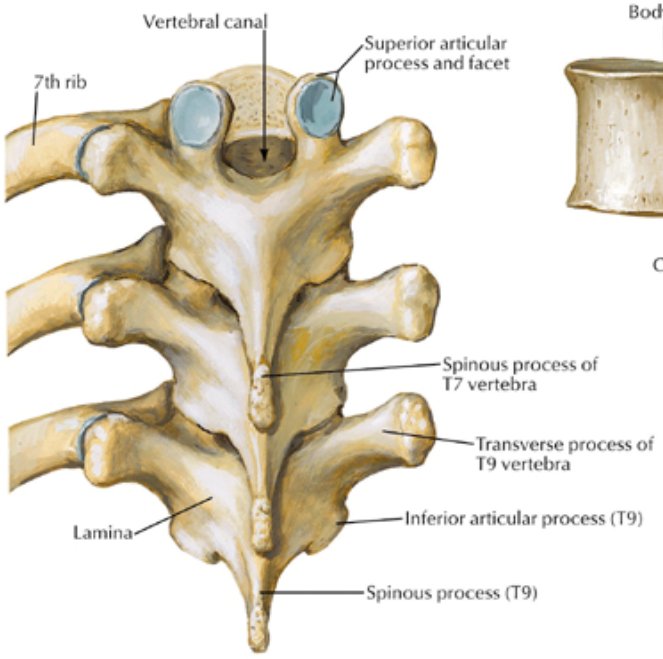
THORACIC VERTEBRAE



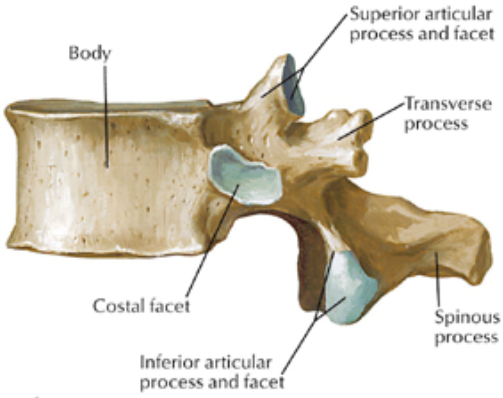
T6 vertebra: superior view



T6 vertebra: lateral view



T7, T8 and T9 vertebrae: posterior view



T12 vertebra: lateral view

THE THORACIC VERTEBRAE

They form the back bone of the thorax. They are 12 in number. They are classified into typical thoracic vertebrae and atypical thoracic vertebrae.

Typical thoracic vertebrae

2^{nd} – 8^{th} thoracic vertebrae.

Atypical thoracic vertebrae

1^{st} , 9^{th} , 10^{th} , 11^{th} and 12^{th} vertebrae.

Typical thoracic vertebra

It has the following parts

1. Body.
2. A pair of pedicles.
3. A pair of laminae.
4. Superior and Inferior articular processes.
5. A pair of transverse processes.

Body

Heart shaped.

Upper and lower surfaces are flat.

The upper facet articulates with the head of the numerically similar rib and lower facet is smaller and articulates with the head of the rib below.

The pedicles

Short process arising near the upper border of the posterior surface of the body. They are directed backwards .

The vertebral foramen

It is small and circular . It lodges the spinal cord and meninges.

The laminae

Short and thick.

Ligamentum flavum is attached to it's border.

The superior articular process

It is situated at the junction of laminae and pedicles.

It is directed backwards and laterally.

The inferior articular process

It is directed forwards and medially.

The transverse process

Strong and thick.

They are directed laterally.

The tips of the transverse process, there are facets to articulate with the tubercles of the ribs to form costo transverse joints.

The spinous process

Upper 4 spines above the pericardium. Middle 4 spines behind the pericardium and lower 4 spines below the pericardium. The spines are directed downwards and backwards.

Atypical thoracic vertebrate

Atypical thoracic vertebrae are 1^{st} ,9^{th} ,10^{th} , 11^{th} and 12^{th} thoraci vertebrae.

FIRST THORACIC VERTEBRA

Special features

1. Body resembles cervical vertebra.
2. No foramen transversorium.
3. Spine is thick and horizontal.
4. The body shows two costal facet. The upper facet is circular and lower facet is semilunar.
5. Superior vertebral notch is very deep.

NINTH THORACIC VERTEBRA

Special features

1. The articular facet to articulate with the head of the 9^{th} rib. Only one facet is present.
2. The spinous process is obliquely situated.

TENTH THORACIC VERTEBRA

Special features

1. Transverse process do not have articular facet.
2. The body shows only one articular facet on either sides .The facets are extending upto the pedicles.

3. Spinous process is obliquely situated.

ELEVENTH THORACIC VERTEBRA

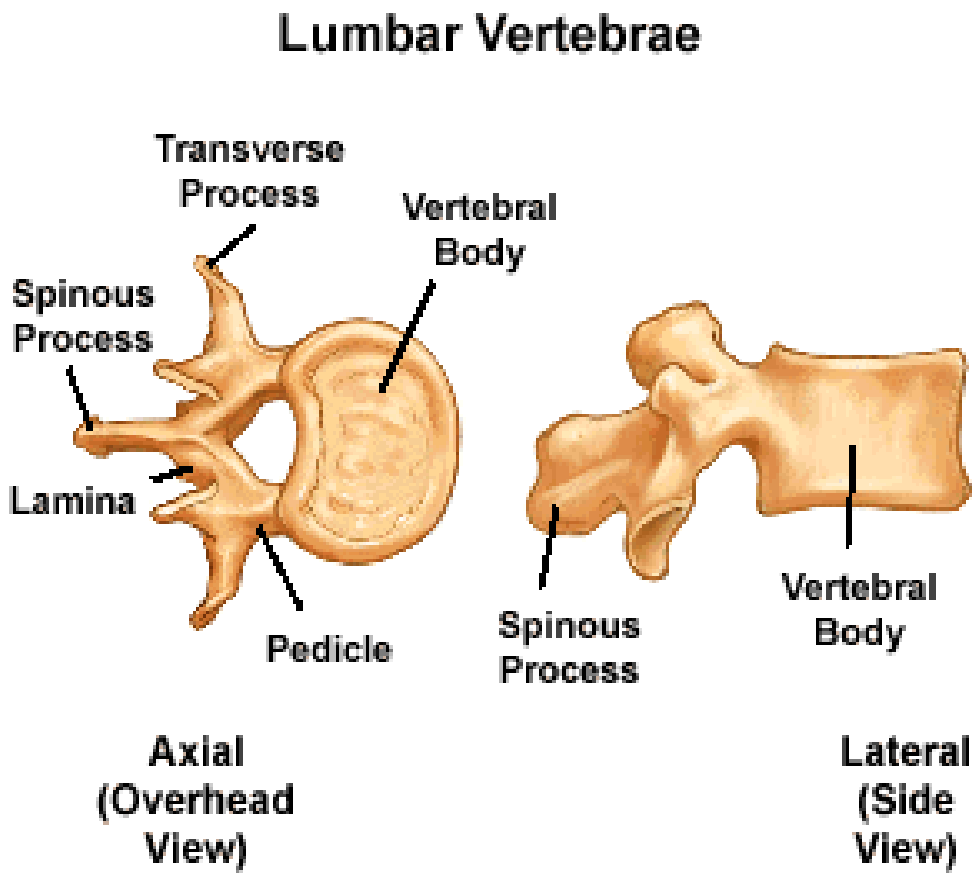
Special features

1. Transverse process has no articular facet.
2. Transverse process is smaller than 10^{th} thoracic vertebra.
3. Circular articular facet on the body extending to the pedicle.
4. The spinous process is obliquely situated. The upper border of the spine is oblique and lower border is horizontal.

TWELTH THORACIC VERTEBRA

Special features

1. Large body with large circular coastal facet.
2. Transverse process is short and shows three tubercles.
3. Transverse process has no articular facet.
4. Spinous process is horizontal.
5. The inferior articular process is large and resembles that of lumbar vertebrae.


Lumbar Vertebrae
Transverse Process
Vertebral Body
Spinous Process
Lamina
Pedicle
Spinous Process
Vertebral Body
Axial (Overhead View)
Lateral (Side View)

LUMBAR VERTEBRAE

The lumbar vertebrae have the same elements as the thoracic vertebrae.

Shape

Kidney shaped bodies.

Pedicles

The thick pedicles arise form the upper 2/3rds of the postero lateral surfaces of the body, superior to a deep inferior vertebral notch.

Laminae

The pedicles join relatively narrow laminae which pass downwards and backwards to meet into a thick rectangular spine.

Vertebral foramen

The laminae and pedicles surround a large triangular foramen.

Articular processes

The inferior articular proceses project inferiorly from the laminae with a v-shaped gap between them . This gap is wider in the lower than the upper lumbar vertebrae.

The curved facets on the antero lateral surfaces of these process fit between the blunt superior articular process which project upwards from the junction of each

pedicle and lamina of the vertebra below the interlocking of the articular processes effectively prevents rotation.

When two adjacent vertebrae are articulated, the V Shaped gap between the inferior articular processes faces a similar gap between the lamina of vertebrae below.

Transverse processes

The transverse processes are thin and spatulate in the upper lumber vertebrae but thicker in the 4^{th} and 5^{th} . In the 5^{th}, the bases of these process extend forwards on to the vertebral body , further thickening the pedicles. The lumbar transverse process is represented by the small accessory process is represented by the small accessory process on the dorsal surface of the transverse process at its base. The accessory process is immediately inferior to the rounded mamillary process which projects posteriorly from the superior articular process.

SPINAL CORD ANATOMY

Protection and coverings

Two types of connective tissue coverings, the bony vertebrae and tough meninges plus a cushion of cerebro spinal fluid surround and protect the delicate nervous tissue of the spiral cord and brain.

Situation

The spinal cord is located within the vertebral canal of the vertebral coloumn.

External Anatomy

The spinal cord is roughly cylindrical but flattened slightly in its anterior-posterior dimension . it the adult, it extends from the medulla, the most inferior part of the brain, to the upper border of the second lumbar vertebra.

The length of the adult spinal cord ranges from 42-45cm. Its diameter is about 2 cm in the mid thoracic region , somewhat larger in the lower cervical and mid lumbar region and smallest at inferior tip . When the spinal cord is viewed externally two enlargements can be seen.

The superior enlargement, the cervical enlargement, extends from the fourth cervical to the first thoracic vertebra. Nerves to and from the upper extremities arise form the cervical enlargement . The inferior enlargement called lumbar enlargement extends from the ninth to the 12 thoracic vertebrate nerves to and from the lower extremities arises from the lumbar enlargement.

Below the lumbar enlargement, the spinal cord tapers to a conical portion known as the conus medullaris, which ends at the level of the intervertebral disc

between the first and second lumbar vertebrae is an adult. Arising from the conus medullaris is the filum terminale, an extension of piamater that extends inferiorly and attaches the spinal cord to the coccyx.

Some nerves that arise from the lower part of the cord don't leave the vertebral coloumn at the same level as they exit from the spinal cord . The roots of these nerves angle inferiorly in the vertebral canal from the end of the cord like wisps of hair . Approximately the roots of these nerves are names the cauda equina meaning "Horse's tail".

INTERNAL ANATOMY

When seen in transverse section, the grey matter of the spinal cord forms an H-shaped mass. In each half of the cord the grey matter is divisible into

1) the anterior grey column (or horn).

2) the posterior grey column (or horn).

In some parts of the spinal cord, a small lateral grey column is also present. The grey matter of the right and left halves of the spinal cord is connected across the midline by the grey commissure which is traversed by the central canal.

The white matter of the spinal cord is divisible into right and left halves , in front by a deep anterior median fissure: and behind by the posterior median septum. In each half the white matter is divided into

i) the posterior white column or posterior funiculus

ii) the lateral white column or lateral funiculus

iii) the anterior white column or anterior funiculus.

The white matter of the right and left sides is continuous across the midline through the white commissure which lies anterior to the grey commissure.

The spinal cord gives attachment, on either side, to a series of spinal nerves . Each spinal nerve arises by two roots;

i) Anterior (or ventral)

ii) Posterior (or dorsal).

Each root is made up of a number of rootlets. The length of the spinal cord giving origin to the rootlets for one spinal nerve constitutes one spinal segments.

As the spinal cord is much shorter than the length of the vertebral column the spinal segments do not lie opposite the corresponding vertebrae. In estimating the position of a spinal segment in relation to the surface of the body it is important to remember that a vertebral spine is always lower than the corresponding spinal segment. As a rough guide it may be stated that in the cervical region there is a difference of one segment; in the upper thoracic region there is a difference of two segments; and in the lower thoracic region there is a difference of three segments.

SPINAL NERVES

There are 31 pairs of spinal nerves. They are attached to the spinal cord. They are arranged as following

Cervical	-	8
Thoracic	-	12
Lumbar	-	5
Sacral	-	5

Coccygeal - 1

Each spinal nerve has ventral and dorsal roots. The dorsal root is attached to posterior horn of grey matter . It has a ganglion called dorsal root ganglion.

The ventral root is attached to the anterior horn of grey matter . The ventral and dorsal roots unites to form the spinal nerve. It divides into dorsal and ventral rami.

Meninges

The spinal cord is surrounded by three Meninges

1. Duramater (outer).
2. Arachnoid mater (middle).
3. Piamater (inner).

Blood supply of the spinal cord

Arterial supply

a) Anterior spinal artery.

b) Posterior spinal arteries.

Spinal branch of

a) vertebral arteries.

b) Deep cervical artery.

c) Posterior intercostal arteries.

d) Lumbar arteries.

The veins of the spiral and drain into the internal venous plexus.

PHYSIOLOGY

Physiology is defined as branch of science dealing with the study of normal functions of living organisms.

Functions of the Vertebral Coloumn

1. It forms the strong Pillar on the back of the neck and trunk.
2. It protects the spinal cord and meninges.
3. it supports the body weight. It transmits the body height to the pelvic girdle.
4. It acts as a shock absorber.
5. Muscles and fascia are attached to it.
6. It forms the central axis of movement of the trunk.

Movements

1. Flexion
2. Extension
3. Lateral Flexion
4. Rotation.

Flexion and extensions movements are taking place only in the cervical region, lumbar region and thoraco lumbar region.

Intervertebral disks

Their Physical characteristics permit them to serve as Shock Absorbers when the load on the vertebral coloumn is suddenly increased, when one is jumping from a height. Their elasticity allows rigid vertebrae to move one upon the other.

The semi fluid nature of nucleus pulposes allows it to change shape and permits one vertebrae to rock forward (or) Backward on another as in flexion.

Spinal Cord Physiology

The tract in white matter of the spinal cord are highways for nerve impulse conduction. Along these highways sensory impulses flow from the periphery to the brain and motor impulses flow from the brain to the periphery. The gray matter of the spinal cord receives and integrates incoming and outgoing information. Both functions of the spinal cord are essential to maintaining homeostasis.

Sensory and Motor tracts

Often, the name of a tract indicates its position in the White matter, where it begins and ends and the direction of nerve impulse conduction. Sensory information from receptors travels up the spinal cord to the brain along two main routes on each side of the cord, the spino thalamic tracts and the posterior coloumn tract.

The spino thalamic tract convey impulses for sensing pains, temperature, crude touch and deep pressure. The posterior coloumn tracts carry impulses for sensing.

1. Proprioception, awareness of the movements of muscles tendons and joints.
2. Discriminative touch, the ability to feel exactly what part of the body is touched.
3. Pressure
4. Vibrations.

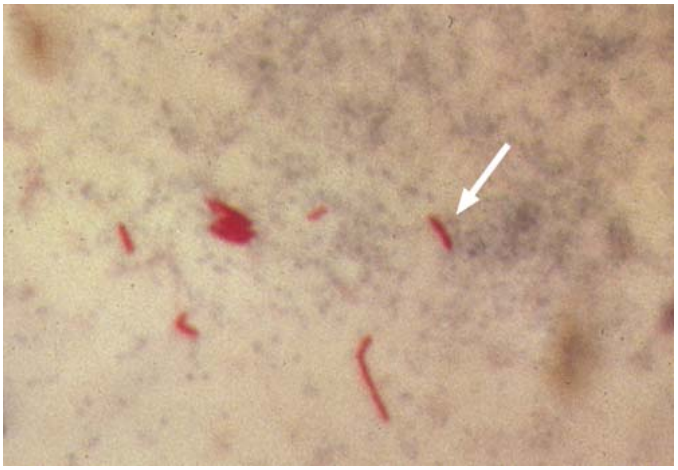
Reflexes

The second principal function of the spinal cord related to homeostasis is to serve as an integrating center for spinal reflexes. Reflexes are fast, predictable automatic responses to changes in the environment that help maintain homeostasis.

Spinal nerves are the paths of communication between the spinal cord and most of the body. The posterior or dorsal i.e sensory root contains sensory nerve fibres and conducts nerve impulses from the periphery into the spinal cord. Each posterior root has a swelling, the sensory neurons from the periphery.

The other point of attachment of a spinal nerve to the cord is the anterior (motor) root. It contains motor neuron axons and conducts impulses from the spinal cord to the periphery. The cell bodies of the motor neurons are located in the gray matter the cord. If a motor neuron supplies skeleton muscle, its cell body is located in the anterior grey horn.

MYCOBACTERIUM TUBERCULOSIS



MYCOBACTERIUM TUBERCULOSIS

Morphology

M.Tuberculosis is a straight or slightly curved rod about 3 μm X 0.3 μm occurring singly, in pairs or as small clumps. The size depends on conditions of growth and long filamentous, club shaped and branching forms may be sometimes seen.

Tubercle bacilli have been described as Gram+ve. Though strictly speaking this is not correct, as after staining with basic dyes they resist decolourisation by alcohol even with out the mordanting effect of iodine. When stained with carbol fuchin by Ziehl – Neelson method or by fluroscent dyes (auramine O, rhodamine) they resist decolourisation by 20 percent sulphuric acid and absolute alcohol for 10 minutes (acid and alcohol fast).

Acid fastness has been described variously to the presence in the bacillus of an unsopanifiable wax (mycoloic acid) or to a semipermeable membrane around the cell. It is related to the cell and appears to be a property of the lipid – rich waxy cell wall. Staining may be uniform or granular.

Cultural Characteristics

The bacilli grow slowly, the generation time in vitro being 14-15 hours. Colonies appear in about two weeks and may sometimes take upto eight weeks.

Optimum temperature is 37^0C and growth does not occur below 25 or above 40^0C Optimum PH is 6.4 – 7.0 .

M.tuberculosis is an obligate aerobe, becoming aerobic on sub culture

Tubercle bacilli do not have exacting growth requirements but are highly susceptible even to traces of toxic substances like fatty acid in culture media the toxicity is neutralized by serum albumin or charcoal.

PATHOLOGY

Tuberculosis of spine or potts disease is a inflammatory bone disorder caused by the tubercle bacilli “Mycobacterium Tuberculosis is a non motile organism that prefers areas of high oxygen pressure. The granulomatous inflammatory reaction to the organism with associated caseating necrosis often involves the sub chondral portion of the bone , so that the articular surface is destroyed . The increased vascularity associated with the inflammatory process resulting doss that is often out of proportion to the degree of associated infection.

Signs and symptoms

- Back pain
- Fever
- Anorexia
- Weight loss
- General weakness
- Muscle weakness and spasticity of legs are the earliest signs of neurological involvement.

Pathology

The pathology starts with the “formation of tubercle” following the insemination of infection , the initial response is in the reticulo endothelial depots of the skeletal tissues . This is characterized by accumulation of polymorpho nuclear cells which are rapidly replaced by macrophages and monocytes, the highly phagocytic members of the reticulo endothelial system.

The tubercle bacilli are phagocytosed and broken clown and their lipid is dispersed throughout the cytoplasm of the mononuclears, thus transforming them into epitheloid cells.

Epitheloid cells are the characteristic feature of the tuberculous reaction these are the large pale cells with a large vescicular nucleus, abundant cytoplasm, indistinct margins, and processes which form an epitheloid reticulum .

Langhans giant cells are probably formed by fusion of number of epitheloid cells. These are formed only if case necrosis has occurred in the lesion, and often they contain tubercle bacilli their main function is to digest and remove necrosed tissue . After about one week , lymphocytes appear and form a ring around the peripheral part of the lesion . This mass formed by the reactive cells of the reticulo endothelial tissues contains a nodule popoularly known as the tubercle.

The tubercle grows by expansion and coalescence . During the second week, caseation occurs in the center of the tubercle by coagulation necrosis caused by the protein fraction of tubercle bacilli . The caseous material may soften and liquefy.

Presence of caseous necrosis is almost diagnostic of tuberculous pathology, such a tubercle is designated as " Soft tubercle".

Tubercular sequestra

Following the infection marked hyperemia and severe osteoporosis takes place osseous destruction takes place by lysis of bone which is thus softened and easily yields under the effect of gravity and muscle action leading to compression , collapse or deformation of bones.

Necrosis also takes place due to ischemic affection of segments of bones this change is secondary to arterial occlusion due to thrombo embolic phenomenon, endarterities and periarteritis . Ischemic necrosis has also been recognized as a contributing factor responsible for and vertebral collapse . Due to loss of nutrition, adjacent articular cartilage or the intervening do gets degenerated and may also become separated as sequestra

Stages occurs in the Potts spine

The stages has been divided into five they are

Stage I - Stage of Implantation , incipient stage or pre destructive stage

Stage II - Stage of Early destruction

Stage III - Stage of Advanced destruction and collapse

Stage IV - Stage of Neurological Involvement

Stage V - Stage of Residual deformity

PATHOLOGY OF POTT'S SPINE WITH NEUROLOGICAL COMPLICATIONS

The patient may give a history of pain at the disease site or along the course of a nerve. It thoracic spine affection takes place , paralysis of the legs is spastic and in the lumbar spine affection , the paraplegia is of lower motor neuron type.

Tubercular lesion is the vertebrae causes extra dural compression and inflammatory odema .

March of Neural deficit

When compression starts anterior to the cord, it shows earliest manifestation a gradual increase in the spasticity which may not be appreciated by the patient . As compression Increases anterior coloumn of cord is affected more and patient starts losing motor power gradually form partial motor weakness to complete motor loss with signs of upper motor neuron lesion.

By the time, compression is severe enough to cause complete block in conduction in anterior column, lateral column is also affected partially, thus

producing some reduction of sensation (pain, temperature and crude touch) when compression is further increased, even posterior column is also affected leading to complete loss of sensation and spasticity is replaced by flaccidity and flexor spasm.

Pathogenesis and Immunity

The natural history and various clinical syndromes of tuberculosis are intimately related to the hosts defences . Tubercle bacilli do not elaborate classic endotoxins or exotoxins rather the inflammatory illness and tissue destruction are mediated by products elaborated by the host during the immune response to the infection.

When an immunologically naïve alveolar macrophage engulfs a tubercle bacillus, it initially provides a nurturing environment within its phagosome in which the bacilli survive and replicate . However, the infected macrophage release a substance that attracts T lymphocytes bacilli to these lymphocytes, initiating a series of committed immune effector cells . The lymphocytes in turn,elaborate cytokines which activates the macrophages enhancing their anti microbial capacity . Thus is set in motion an elaborate, delicately balanced struggle between the host and the parasite.

Among normal adult persons, the host initially prevails in over 95% of cases. However this initial encounter typically extends over a few weeks to several months

during which the bacillary population has proliferated massively and undergone variable degrees of dissemination.

Through complex interactions involving mono nuclear phagocytes and various T – cell subsets, host defenses are enhanced. This results in more competent macrophages capable of inhibiting the intracellular replication of mycobacteria. Also disruption of permissive macrophages that support. Bacillary multiplication occurs in order that more competent macrophages may engulf and limit the growth of the mycobacteria. These phenomena are broadly referred to as a cell mediated immunity and delayed type hypersensitivity respectively.

DISCUSSION

Asuvathamba vadham, a clinical entity which is described in Siddha literature “yugi vaidhya chinthamani “ is taken for the detailed study.

The patient with Asuvgathamba vadham were selected and were interrogated thoroughly. Their history, etiology, characters of signs and symptoms were noted in the materials and methods on observation.

The parameters being used in Siddha aspects and Modern parameters were also used.

Age and sex distribution

Both sexes are affected and occurs at any age in the life time.

Family History

Both patients shows negative family history.

Socio – economic status

Socio – economic status plays a vital role in this disease. Since the bacilli infects the immuno suppressed patients easily . Both patients are under poor socio – economic status.

Mukkutram reference

Vadham , Pitham and Kabam were involved in “ Asuvathamba vadham”.

Vadham

In this disease mainly Vadham is affected. Among the types of Vadham, paranan, Abanan, viyanan, Udhanan, samanan, kirukaran and devadhathan was dearranged.

Pranan - Dyspnoea.

Abanan - Difficulty in walking due to loss of motor reflexes.

Viyanan - Difficulty is walking.

Udhanan - Cough.

Samanan - Disturbances is controlling other Vayus.

Kirukaran - Giddiness.

Devadhathan - Generalised malaise.

Pitham

Among the types of Pitham Anar pitham, Rajagam, Saathagam, Prasagam were affected.

Anarpitham - Loss of appetite.

Ranjagam - Anaemia.

Saathagam - Difficulty in walking due to pain and weakness.

Pirasagam - Pallor of the body.

Kabam

Among the types of kabam, Avalambagam, Kilaethagam, Sadhigam were affected.

Avalambagam	-	Dyspnoea.
Kilaethagam	-	Loss of appetite.
Pothagam	-	Pain and weakness of the body.
Sandhigam	-	Destruction of bone.

Udal Kattugal

Saaram, Senneer, Oonn, Kozhuppu, Enbu, Moolai are affected

Saaram	-	Generalised malaise.
Senneer	-	Anaemia.
Oonn	-	Emaciation.
Kozhuppu	-	Reduction of kozhuppu.
Enbu	-	Destruction of enbu.
Moolai	-	Destruction of moolai.
Sukkilam / Suronitham	-	Affected.

Interpretation of Envagai thervugal

Among this Niram, Sparism, Naa were involved

Niram	-	Pallor of the body.
Sparism	-	Fever.
Naa	-	Pallor of the tongue.
Neerkuri	-	No specific changes.
Neikuri	-	The Neikuri exhibited incurable nature of the disease.
Naadi	-	Vadha kabam.

Interpretation of Allied parameters

In this disease, From the routine examination.

Blood investigations - Shows normocytic hypochromic anaemia

Increased Erythrocyte sedimentation rate.

Urine Examination - Shows no specific changes.

Special Investigations

Mantoux test - Positive.

Radiological Examination

Increased density of vertebral body and shows wide separation of the sequestrated fragments of vertebral body.

Computed tomography scans

Destruction of low signal intensity cortical end plates of L1,L2,L3 and L4 vertebrae seen.

Vertebral osteolytic secendaries

Annular disc buldge L3 –L4, L4 – L5 and L5 and S1 suggestive of pott's spine.

Magnetic resonance imaging scans

Alteration of Alignment of at D12 – L1 with acute kyphosis and compression of cord at that level.

There is complete destruction of disc at D12 – L1 and partial destruction at L1 and L2.

Narrowing of spinal canal at D12 – L1 region.

CONCLUSION

"நோய்நாடி நோய்முதல் நாடி அது தணிக்கும்
வாய்நாடி வாய்ப்பச் செயல் "

- திருக்குறள்

By this every disease must be identified from the root cause itself. It is the main duty of the physician to bring out the causes of the disease and then the manifestations . Then only the treatment attain fulfillment as the primary cause is clarified.

It is one of such research work based on, **"ASUVATHAMBA VADHAM"** disease explained by yugi in Yugi vaidhya chinthamani to reveal the etiology and the pathology hidden, to the needy world.

By the outcome of the result of this research work. **"ASUVATHAMBA VADHAM"** is a chronic inflammatory disorder caused by the Infection of Bacillus "Mycobacterium tuberculosis " in the spine **"POTT'S SPINE"** and its complications.

AnnexureS

Name of the medical unit	:	Nationality	:
I.P No. / O.P No	:	Religion	:
Name	:	Date of Admission	:
Age	:	Date of discharge	:
Sex	:	No of Days Treated	:
Occupation	:	Diagnosis	:
Income	:	Results	:
Address	:	Medical Officer	:

Complaints & Duration

H/O Present illness :

H/O Previous illness :

Personal History :

Family History :

Clinical Examination - Siddha Aspect

General Examination

Yakkai :

Gunam :

Irukkai Nilai :

Padukkai Nilai :

Nadi enn :

Suvasa enn :

Kuruthi azhutham :

Special Examination

PoriPulan

Mei	-	Sensation	:
Vaai	-	Taste	:
Kan	-	Sight	:
Mooku	-	Smell	:
Sevi	-	Hearing	:

Kanmendhiriyam/ Vidayam

Vaai	-	Vasanam	:
Kai	-	Dhanam	:
Kaal	-	Kamanam	:
Eruvai	-	Visarkam	:
Karuvai	-	Anantham	:

Paruvakalam :

Kaarkalam	:
Koothirkalam	:
Munpanikalam	:
Pinpanikalam	:
Ilavenikalam	:
Mudhuvenil Kalam	:

Utkayam / Athakayam :

Puyam	-	Fore arm	:
Sayam	-	Arm	:

Kaal - Leg :

Paadham - Feet :

Uyir Thathukkal

1.Vatham

Piranan :

Abanan :

Viyanan :

Udhanan :

Samanan :

Nagan :

Koorman :

Girugaran :

Thaevathathan :

Dhananjeyan :

2. Pitham

Anilam :

Ranjagam :

Pirasagam :

Aalosagam :

Sathagam :

3. Kabam

Avalambagam :

Kilethagam :

Pothagam :

Tharpagam :

Sandhigam :

Ezhu Udal kattugal

Saaram :

Senneer :

Oonn :

Kozhuppu :

Enbu :

Moolai :

Sukkilam / Suronitham :

EN VAGAI THERVUGAL

MEIKURI (SPARISAM)

Examination of the skin

Inspection :

Colour of the skin

Eruptions

Haemorrhages

Ulcers, excoriations, fissures, etc.,

Boils, carbuncles, scars, trophic changes etc.

Eruptions

Types of Rashes

- Macular
- Roseolar
- Erythematous
- Papular
- Pustular
- Lenticular
- Nodular
- Vesicular
- Bullous
- Wheals
- Burrows
- Blackheads
- Plaques
- Scales

Ulcers

- Duration
- Mode of onset
- Associated Pain
- Size and shape
- Nature of floor

Character of the edge

Discharge

Tenderness

Surrounding skin

Lymph nodes

Pruritis

Infestation

Skin diseases

Metabolic & endocrine

Hepatic disorders

Renal diseases

Blood diseases

Examination of the hair

Falling of the hair

Patchy loss of hair

Loss of hair in temporal region

Characteristic features of the hair

Sweat

Physiological / Pathological

Lymph glands :

Site

Shape

Size

Consistency

Mobility

Tenderness

Examination of the nails

Examination of the Head,

Neck, Face

Skull

Size

Shape

Face

Eyebrows

Eyelids & Eye lashes

Nose

Lips

Ears

Neck

Examination of the Chest

Shape and size

Movements

Rate of respiration

Breath sounds : Normal / Abnormal

Heart Rate & sounds

Examination of the Breast

Examination of the Abdomen

Shape

Size

Examination of the Genital organs

Examination of the Extremitis

Upper & Lower Limb : General Examinations, Special Examinations

Tests for Tone, Power & reflex

NIRAM

Colour of the Skin, Hair, Nail, Teeth, Tongue

Gums

Sputum - Normal / Abnormal

MOZHI

Larynx

Congenital

Acquired

Traumatic

Tongue

Congenital Abnormalities

Ear : Deafness

Palate : Cleft Palate

VIZHI

Examination of Eye

Visual acquity

Visual field

Colour sense

Pupil

Size

Equality

Regularity

Reaction of light accommodation

NAA

Colour

Size

Shape

IRU MALAM

Malam

I Macroscopic Examination

Amount

Colour

Odour

Consistency

Abnormal Constituents

II Microscopic Examination

III Chemical Examination

SIRUNEER

Quantity

Colour & Transparency

Deposit

NAADI

The state of Vatha, Pitha and Kaba Naadi

Examination of pulse & its indication

Rate

Rhythm

volume

Force & Character

MODERN ASPECTS

Annexure - II General Examination

Consciousness	:	General Appearance	:
State	:	Nourishment	:
Weight	:	Facies	:
Height	:	Jaundice	:
Skin changes	:	Engorged veins	:
Anaemia	:	Clubbing	:
Cyanosis	:	JVP	:
Pedal oedema	:	Koilonychia	:
Abdominal distension	:	Brittle Nail	:

Congenital anomaly :

Lymphadenopathy :

Pulse : Rate, Rhythm, volume, Character

			R	L
Blood Pressure	: mm/hg	Upper Limb	---------	---------
		Lower Limb	----------	---------

Respiratory Rate :

Systematic Examination

Cardio Vascular System :

Respiratory System :

Gastro intestinal System :

CENTRAL NERVOUS SYSTEM

Examination of Central Nervous System

Handedness

Higher Function tests

Mental Functions

Appearance

Behaviour

Communication

Intelligence

Educational level

Language

Dressing

Interest on sorrounding

Expression to greeting

Conversation

2. Emotion

3. Sleep

4. Delusion and hallucination

5. Orientation : Time

Place

Person

6. Clouding of consciousness (Dementia I Delirium)

7. Memory : Remote Memory

Recent Memory

Immediate Memory

8. Speech : Articulation

Fluency

Verbal comprehension

Naming

Repetition

Reading

Writing

Aprexia

Acalculia

Alexia

Comprehension of language, visual field

Cranial Nerves: **R** **L**

1. Olfactory nerve

Smell

2. Optic nerve

Acquity of vision

Field of vision

Colour vision

Accommodation reflex

Light reflex

3. Oculomotor nerve

4. Trochlear nerve

5. Trigeminal nerve

Sensation on face

6. Abducent nerve

Movements of eyeball Diplopia

7. Facial nerve

Wrinkling of forehead

Closing the eyelids

Showing teeth

Whistling

Blowing the cheek

Eating

Taste in the anterior 2/3rd of the tongue

H/o Hyperacoustics

8. Vestibulo cochlear nerve

Hearing

Rinnes test

Webers test

H/o Vertigo

9. Glossopharyngeal nerve

Taste in the posterior l/3rd of the tongue

Gag reflex

Palatal reflex

10. Vagus nerve

Gag reflex

H/o Nasal regurgitation

11. Spinal accessory nerve

Shrugging of shoulder

Turning the head against resistance

12. Hypoglossal nerve

Movement of tongue

Tongue deviation

Fasciculation

Wasting

Spinal motor system : **R** **L**

1. Bulk of muscles

Upper arm

Fore arm

Thigh Leg

2. Tone

Upper Limb (Flexors)

Lower Limb (Extensors)

3. Power

Upper limb

Shoulder (Flexion, extension, abduction, adduction,

rotation)

Elbow (Flexion & extension)

Wrist (Flexion, extension, supination, pronation, adduction, abduction)

Lower Limb

Hip joint (Flexion, extension, abduction, adduction, rotation)

Knee joint (Flexion, extension)

Ankle joint (Dorsi flexion, plantar flexion, inversion, eversion)

4. Reflexes : R L

Superficial reflex

Corneal reflex

Abdominal reflex

Cremastric reflex

Plantar reflex

Oppenheims sign

Gardon reflex

Hoffman reflex

Westergrens sign

Deep reflex

Biceps jerk

Triceps jerk

Supinator jerk

Knee jerk

Ankle jerk

Jaw jerk

Clonus

Ankle clonus

Patellar clonus

Released reflexes (Primitive reflexes)

Grasp reflex (radial border)

Avoiding reflex (ulnar border)

Palmomental reflex (thenar eminence)

Sucking reflex (angle of mouth)

Snout reflex

Glabellar tap reflex

5. Coordination :

Upper Limb

Finger nose test

Finger - finger nose test

Tapping in a circle test

Dysdiadochokinesis

Lower Limb

Knee shin ankle test

Draw a circle in air

Tandem walking

Footpat test

Underbergers test

6. Involuntary movements :

Epilepsy, myoclonus, tremor, athetosis, chorea, hemiballismus, dyskinesia, dystonia, torticollis, tics, myokymia, asterixis, tetany and cramps

7. Spinal sensory system : **R** **L**

Superficial

Touch

Pain

Temperature

Deep

Pain

Position sense

Joint sense

Vibration sense

Tactile localisation

Two point discrimination

Stereognosis

Graphaesthesia

Sensory inattention

8. Cerebellar signs :

Dyssynergia

Dysmetria

Dysdiadocholansis

Rebound phenomenon

Hypotonia

Abnormalities of gait

Speech disturbances - scanning, dysarthria

Nystagmus

Pendular knee jerk

Intension tremor

Titubation

9. Gait :

10. Signs of meningeal Irritation

Neck stiffness

Kernigs' sign

11. Bruit :

Face

Occiput

Carotid

Laboratory Investigations

Blood

TC	:	MCV	:
DC : F5L,E,B,M	:	MCH	:
Hb %	:	MCHC	:
ESR	:	Serum Protein	:
1/2 hr	:	Serum Cholestrol	:

1 hr	:	Blood Urea	:
RBC Count	:	Serum Iron	:
Platelet Count	:	Serum Ferritin	:
Reticulocyte Count	:	Peripheral Blood	
PCV	:	Smear	:

Motion

Ova :

Cyst :

Occult Blood :

Urine

Albumin :

Sugar :

Deposits :

Bile Salt :

Bile Pigment :

Special Investigations

Barium Meal and endoscopy :

Bone marrow examination :

Skiagram Sputum for AFB :

Radiological investigation :

Ophthalmoscopic examination :

ECG :

ETC :

Case summary :

Fate of the disease :

Line of treatment :

Systemic Examination – Locomotor System

Examination of the Spine and its Joints

A) Inspection

1. Skin Over the Vertebrae.
2. Attitude and Deformity.
3. Muscular Wasting.
4. Trophic Changes.
5. Swelling.
6. Fasciculations.
7. Gait.

B) Palpation

1. Local Temperature.
2. Tenderness.
3. Rigidity and deformity.
4. Wasting.
5. Swelling.

   Position.

   Extent.

Consistency.

Fluctuation.

6. Lymphadenopathy.
7. Cold abscess.

In lion.

In Abdomen.

In Cervical Region.

c) Movements

1.Painful / Not Painful.

2.Restricted / Not Restricted.

3. Excess Mobility in any direction present / not present.

4.Movements of Hip.

i) Rotation.

ii) Flexion.

iii) Extension.

iv) Lateral Bending.

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